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students to the sciences of comparative anatomy, comparative embryology, cytology, general physiology, variation and inheritance, and the others that are grouped under 'zoölogy.' This book is like a 'Synoptic Room' in the vestibule of a vast museum, containing the most essential things for those who can go in but a little way, but also fundamental for those who can penetrate farther."

This Natural History, vivified by general physiology, seems worthy to replace many of the school text-books now in use, if only the teacher be prepared to make the field and laboratory work dominate over the "cram" which presentation of so many facts makes an opening for.

The three hundred and eleven illustrations are a most important feature, remarkable in that the majority are from original photographs. Many of these are excellent, and, as the authors state, "their publication may be considered as something of a contribution to science." Yet it is to be regretted that, in some illustrations of invertebrates, black photographs have been preferred to good drawings; while, on the other hand, in the higher groups, notably the mammals, drawings of stuffed specimens have been used, where photographs from life, such as those of Gambier Bolton, might have been used to advantage.

We hope the book will meet with a success that will insure revisions. Meanwhile, the "blue crab" figured on page 109 will be of peculiar interest to the specialist.

E. A. A.

**Merogeny.** — The notable work of Yves Delage, first published in the *Comptes Rendus*, October, 1898, and in detail in the *Archives de Zoologie Experimentale*, VII, Nos. 3 and 4, 1899, widens the field of experimental research by a new method, and adds facts difficult to assimilate with the current conceptions of the phenomena of fertilization.

In the echinoderms *Strongylocentrotus lividus* and *Echinus sp.*, in the mollusk Dentalium, and in the annelid *Lanice conchylega*, he has succeeded in cutting eggs into two or more pieces and in keeping these pieces under observation in drops of water till they developed into the characteristic larvæ of these groups. In each case sperm was added, and it is inferred that it entered and fertilized the pieces. Moreover, in some echinoderm eggs the egg nucleus was seen in one piece and not in the other; yet the piece with no nucleus formed a larva just as well as did the piece with a nucleus. It is inferred that most of the fragments were without nuclei.

This development of fertilized, enucleated pieces of eggs the author calls merogenetic development.

In cleaving, such fragments tend to be abnormal at first, but by progressive self-regulation normal larvæ are formed.

In the sea-urchin three larvæ were got from one egg, and in another case an active blastula was obtained from a piece of egg one-thirty-seventh of the bulk of the normal egg.

In this well-controlled Gallic method of cutting a single egg while under observation under the microscope we seem much more sure of the results than in the former gross Teutonic method of shaking eggs wholesale in a tube, to break them to pieces. Still, the author finds it necessary to give reasons for rejecting the ideas, — that the egg was fertilized before cutting; that the cutting itself acted as a stimulus; and that the nucleus might have been cut to supply parts to each piece of egg.

In this he seems successful, except as to the last point, and we may still have doubts regarding the assumed restriction of the nucleus, or the nuclear matter, to one of the pieces. Another possibility, or indeed probability, the occurrence of polyspermy in these fragments, seems to have escaped the author's attention. This may vitiate some of his most important conclusions.

Incidentally the author points out that the cut halves of an egg may be drawn together again by the viscous envelope (we presume Hammar's layer) that is not necessarily severed. There is no evidence of "cytotropism" in this. On the other hand, there is often an abnormal tendency of the blastomeres to fall apart; we infer this is a state similar to that induced by Herbst in removing calcium.

It is interesting to find that the enucleated pieces may be bastardized by sperm of a related animal, but they do not develop when treated with the sperm of a widely different animal. In this the author sees the importance of the cytoplasm; and he also finds evidence of a maturation of the cytoplasm. Thus a ripe and an unripe egg in two drops on the same slide, when cut and treated with sperm, yielded for the ripe egg cleaving pieces in six out of ten cases, and none at all in the unripe eggs.

Granting that these merogenic larvæ are actually fertilized, enucleated pieces of an egg, it is a very remarkable fact that they have eighteen chromosomes in the nuclei of their cells, for this is the normal number that is commonly held to have come about by the addition of nine chromosomes in the sperm to nine in the nucleus of the egg, yet in this case we start with only the nine of the sperm and have no egg nucleus at all in the fragment studied. Delage concludes that the constant number of chromosomes, *n*, is a constant factor of the cells, as are the contractile or secretive functions of cells, and that it is not produced by the activities of chromosomes acting as individuals.

In the last paper he defines his position as to the meaning and nature of fertilization. Assuming that experiment has shown that a piece of egg protoplasm, with no nucleus, can form an embryo if combined with a sperm, and not otherwise, he affirms that the essential thing in fertilization is this union of egg cytoplasm with the sperm. The egg nucleus is not necessary for the formation of a larva. Moreover, his experiments show that the per cent of fragments developing is larger than the per cent of whole eggs developing under given conditions, and he infers that the egg nucleus is not only unnecessary, but even a hindrance to fertilization.

In normal fertilization he regards the nuclear phenomena as rather a *substitution* of a male for a female nucleus than as a combination of the two. He does not deny that the egg nucleus is of use to the race in aiding in handing down characters of the maternal side, it may be; but to the making of the individual it is not useful, but detrimental.

Accepting the recent experiments upon echinoderm eggs, in which they are stimulated by chemical agents to develop parthenogenetically, he supposes that in fertilization the sperm nucleus is the active stimulating factor, while the egg nucleus is inert — to such an extent as to inhibit the sperm to some extent. Extending this idea, he supposes that the process of maturation of the egg is to be interpreted as follows. The polar bodies take from the egg nuclear matter and so reduce the inertness of the egg nucleus to a point where the sperm may overcome what is left. Were there no polar bodies, the sperm could not overcome the inertness of the entire egg nucleus.

E. A. A.

**Skeleton of the Black Bass.** — The skeleton of the black bass, on which Dr. Shufeldt has already made several interesting reports, has been described by him in full in a recent memoir.[1] This is accompanied by eight well-executed figures which illustrate in particular the structure of the skull of this fish. The text includes

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[1] Shufeldt, R. W. The Skeleton of the Black Bass, *U. S. Fish Comm. Bulletin for 1899*, pp. 311–320. 1900.